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Aneas

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(54) **DEVICE FOR STOPPING A CONTAINER, CONTAINER PROVIDED WITH SUCH A DEVICE, AND METHOD FOR CLOSING A BATCH OF SUCH CONTAINERS**

(75) Inventor: **Antoine Aneas**, Menetrol (FR)

(73) Assignee: **West Pharmaceutical Services Deutschland GmbH & Co. KG**, Eschweiler (DE)

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This patent is subject to a terminal disclaimer.

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(Continued)

(52) **U.S. Cl.**
CPC ***B65D 51/18*** (2013.01); ***A61J 1/1412*** (2013.01); ***B65D 51/002*** (2013.01);
(Continued)

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CPC B65B 1/04; B65D 39/00; B65D 41/58; B65D 51/18; A61J 1/2089
USPC 215/251, 258, 272, 364, 249, 277, 307, 215/224, 311, 308; 34/296, 242, 287; 604/406, 415, 416, 414; 220/790, 320, 220/787; 53/485
See application file for complete search history.

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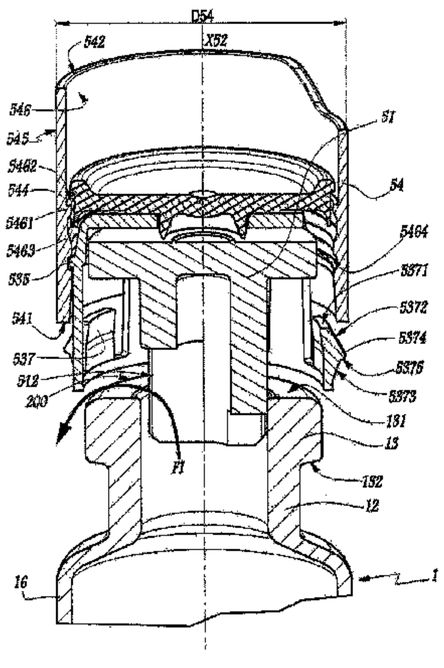
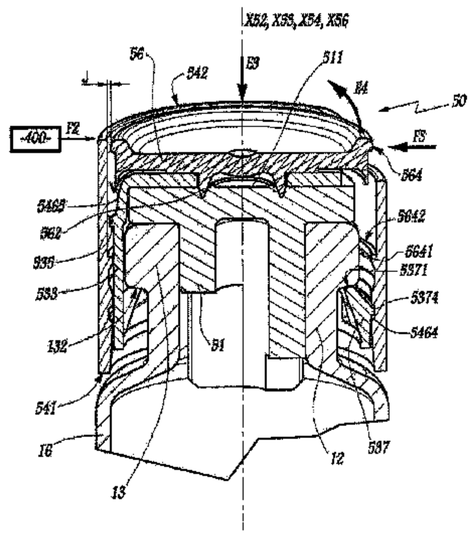
Primary Examiner — Mickey Yu
Assistant Examiner — Gideon Weinerth
(74) *Attorney, Agent, or Firm* — Panitch Schwarze Belisario & Nadel LLP

(57) **ABSTRACT**

A stopper device including a stopper, cap and ring provided with tabs for locking onto a container neck and a body for handling the ring. The body includes a first mechanism for transmitting a thrust force to the ring and a second mechanism for activating the tabs. The ring and the handling body are respectively provided with first and second retainers that hold the handling body in a waiting position. The handling body is mobile parallel to the thrust force direction and in relation to the ring, between a first position activating the tabs of the ring and is mobile in translation only in the thrust force direction, and a second position that also activates the tabs and is immobilized in relation to the ring in axial translation. The tabs extend from a continuous edge of the ring and are each arranged in an opening with a closed contour.

11 Claims, 8 Drawing Sheets





(51) **Int. Cl.**

B65D 51/18	(2006.01)
A61J 1/14	(2006.01)
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CPC ***B65D 51/241*** (2013.01); ***B65B 7/28*** (2013.01); *B65D 39/00* (2013.01); *A61J 1/1406* (2013.01); *A61J 2001/1425* (2013.01)

USPC **215/247**; 215/251; 215/250; 215/307; 215/277; 215/273; 215/364; 215/272; 220/790; 220/787; 220/320; 604/415; 34/284; 34/296; 34/287

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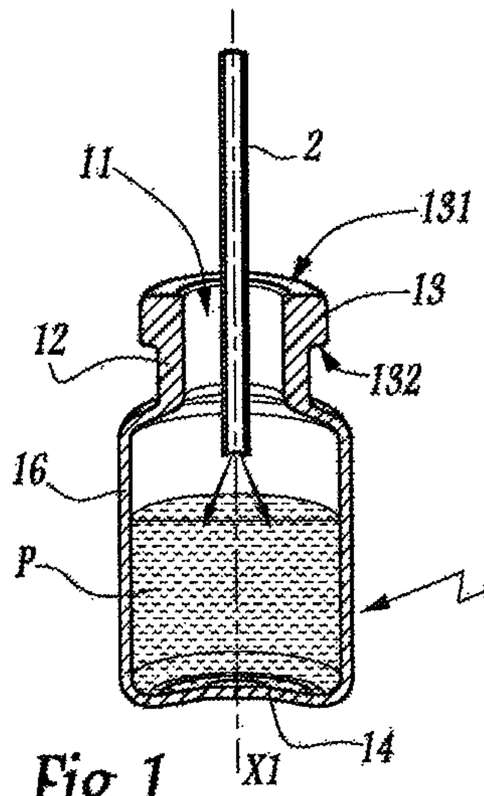
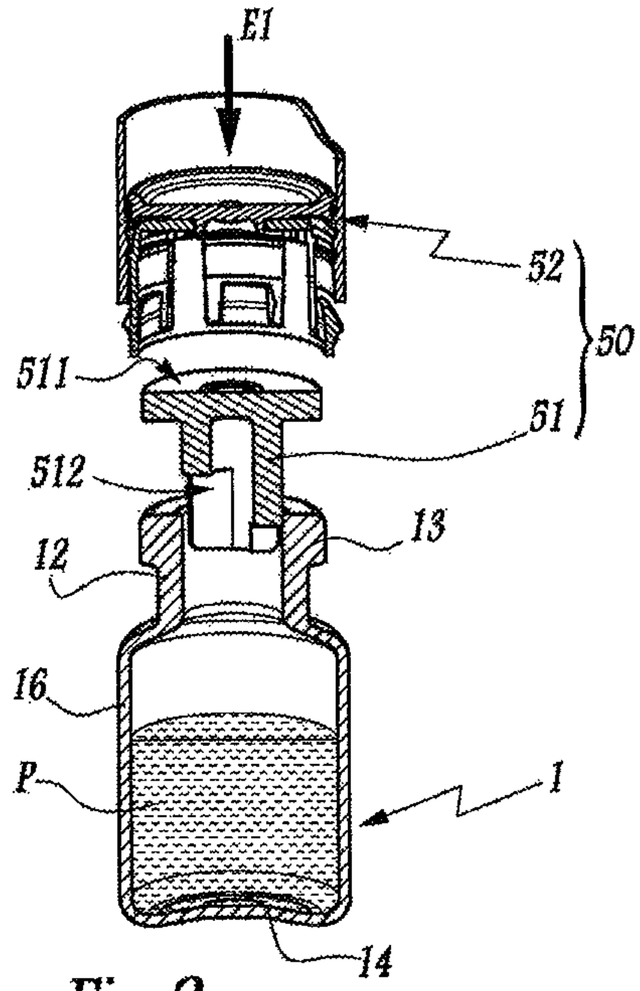


Fig. 1



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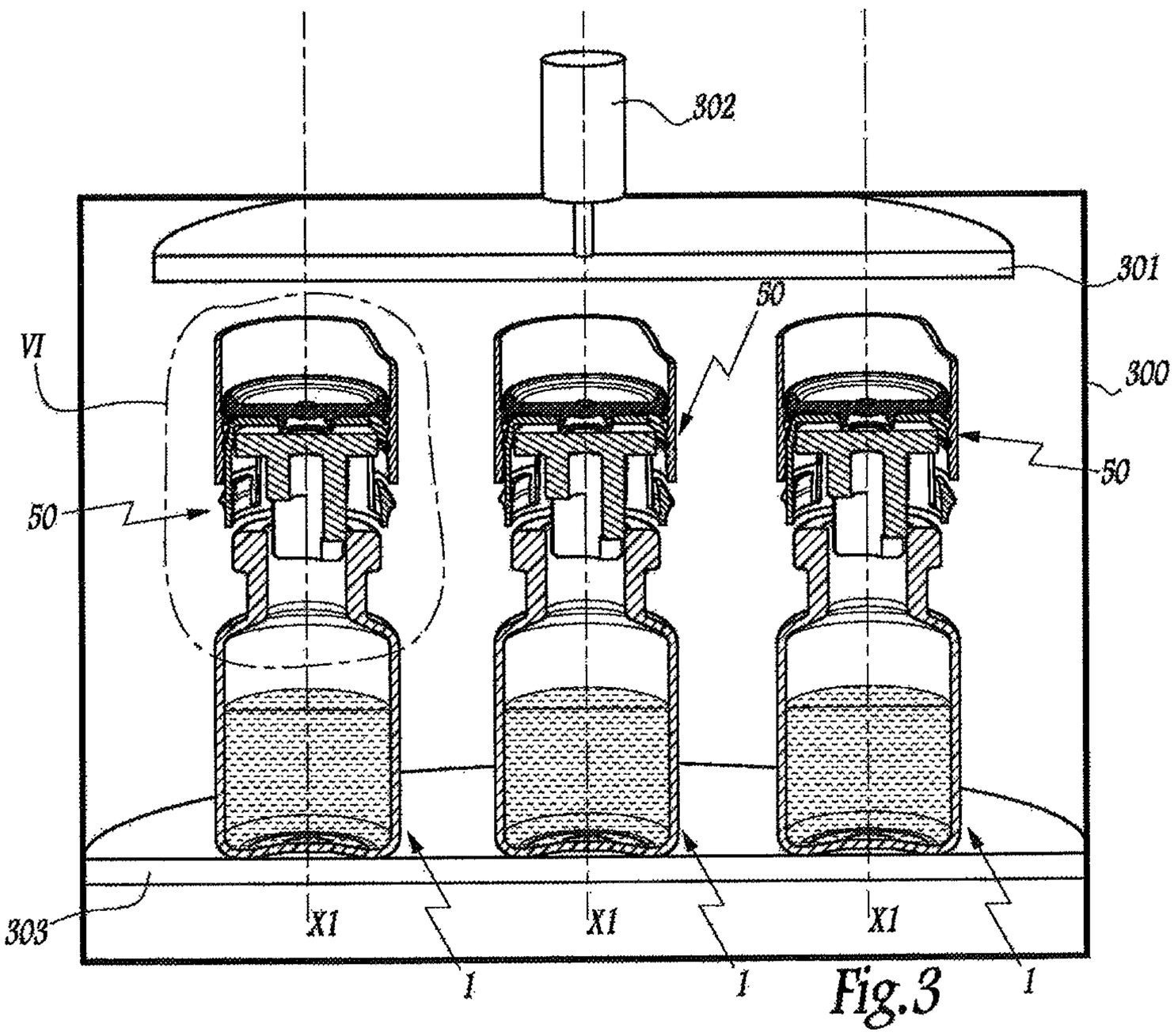

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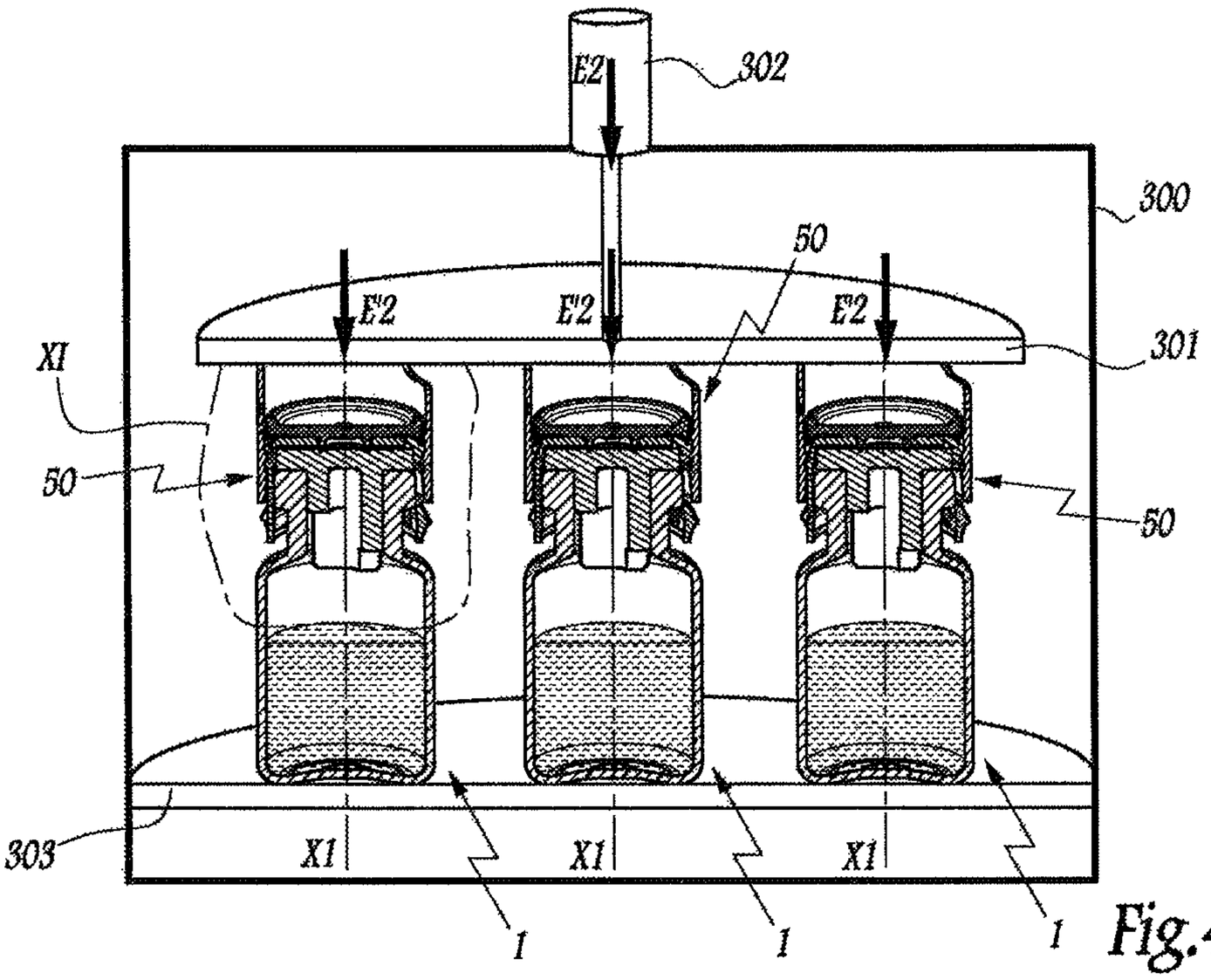
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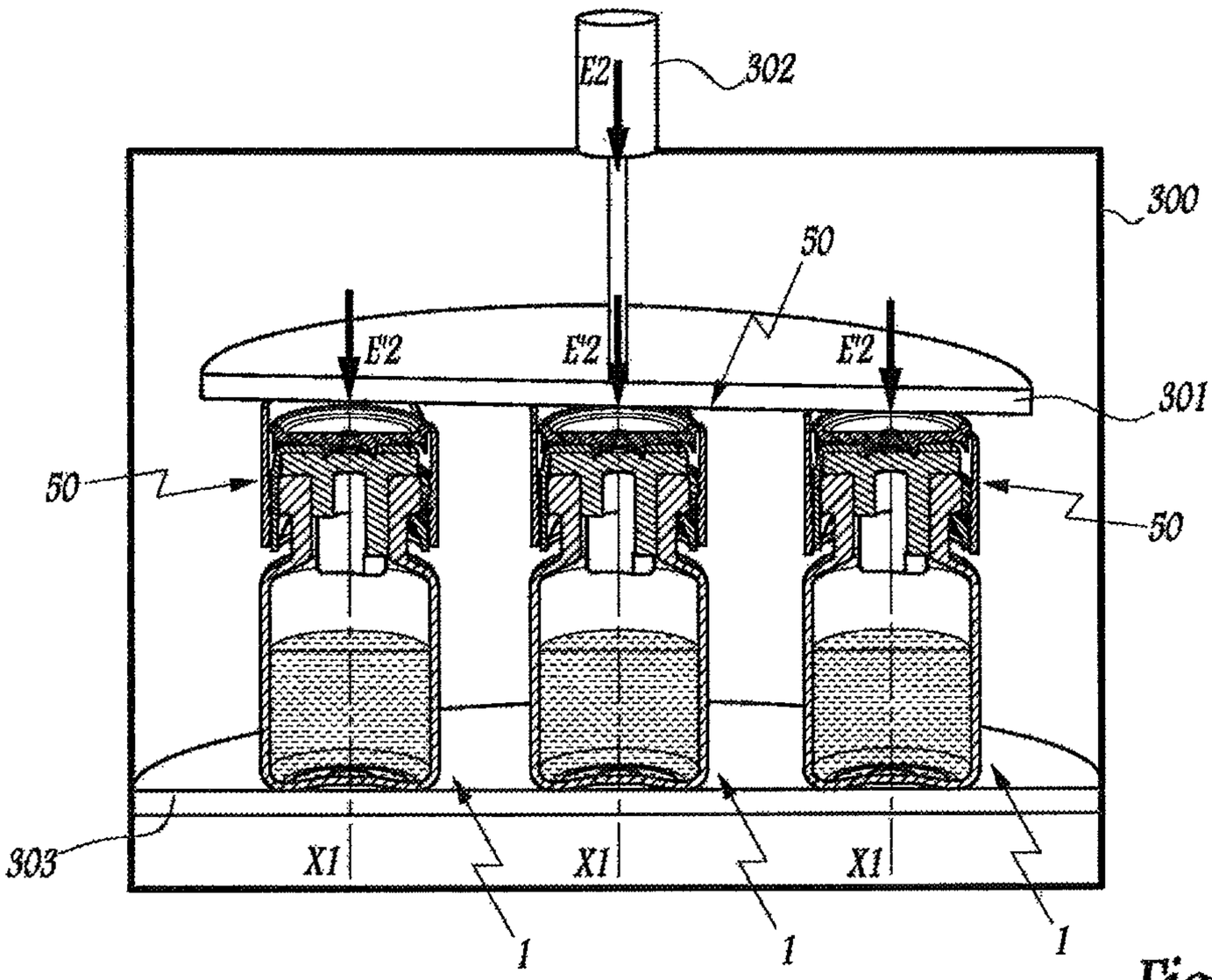
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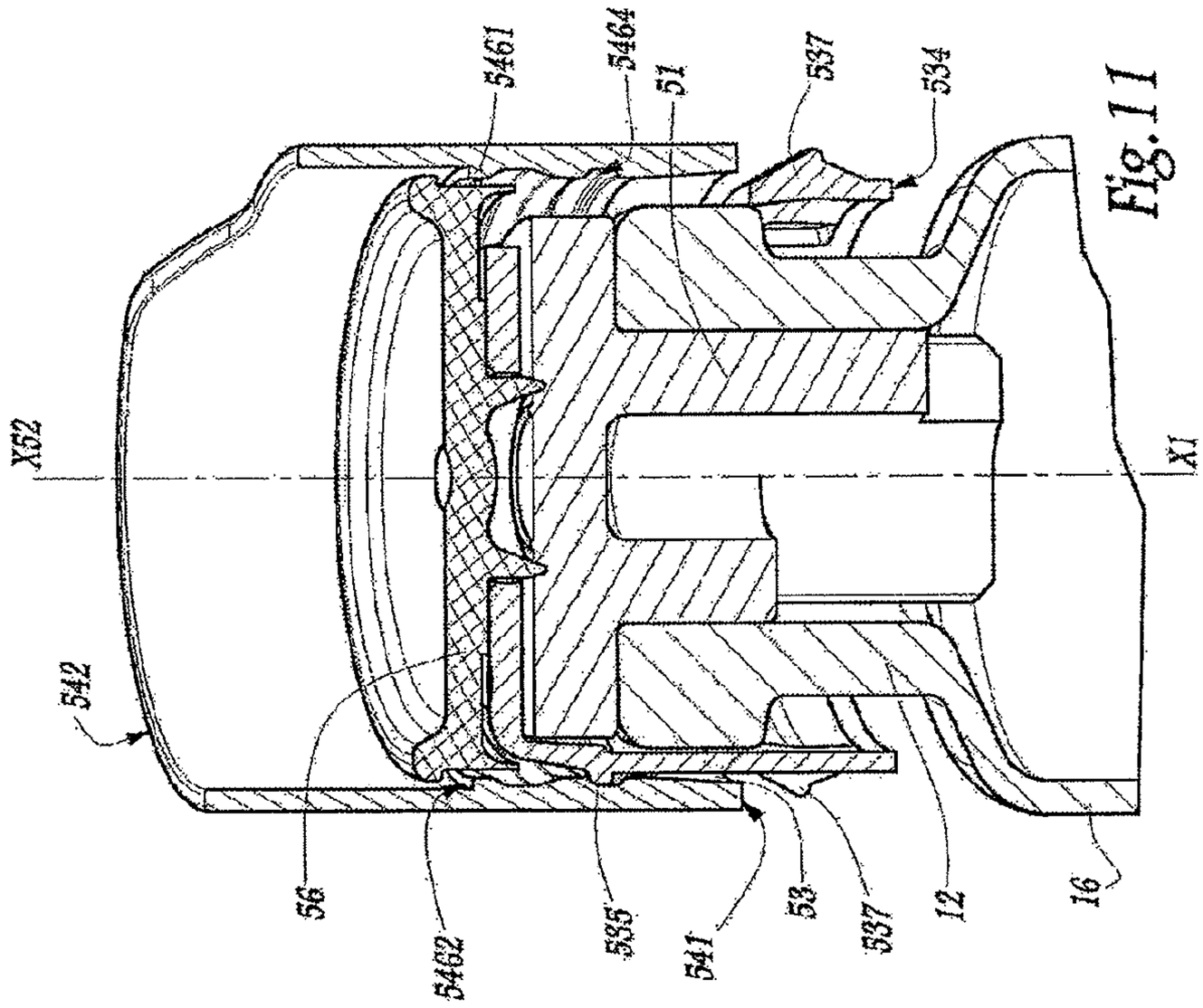
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Fig. 11

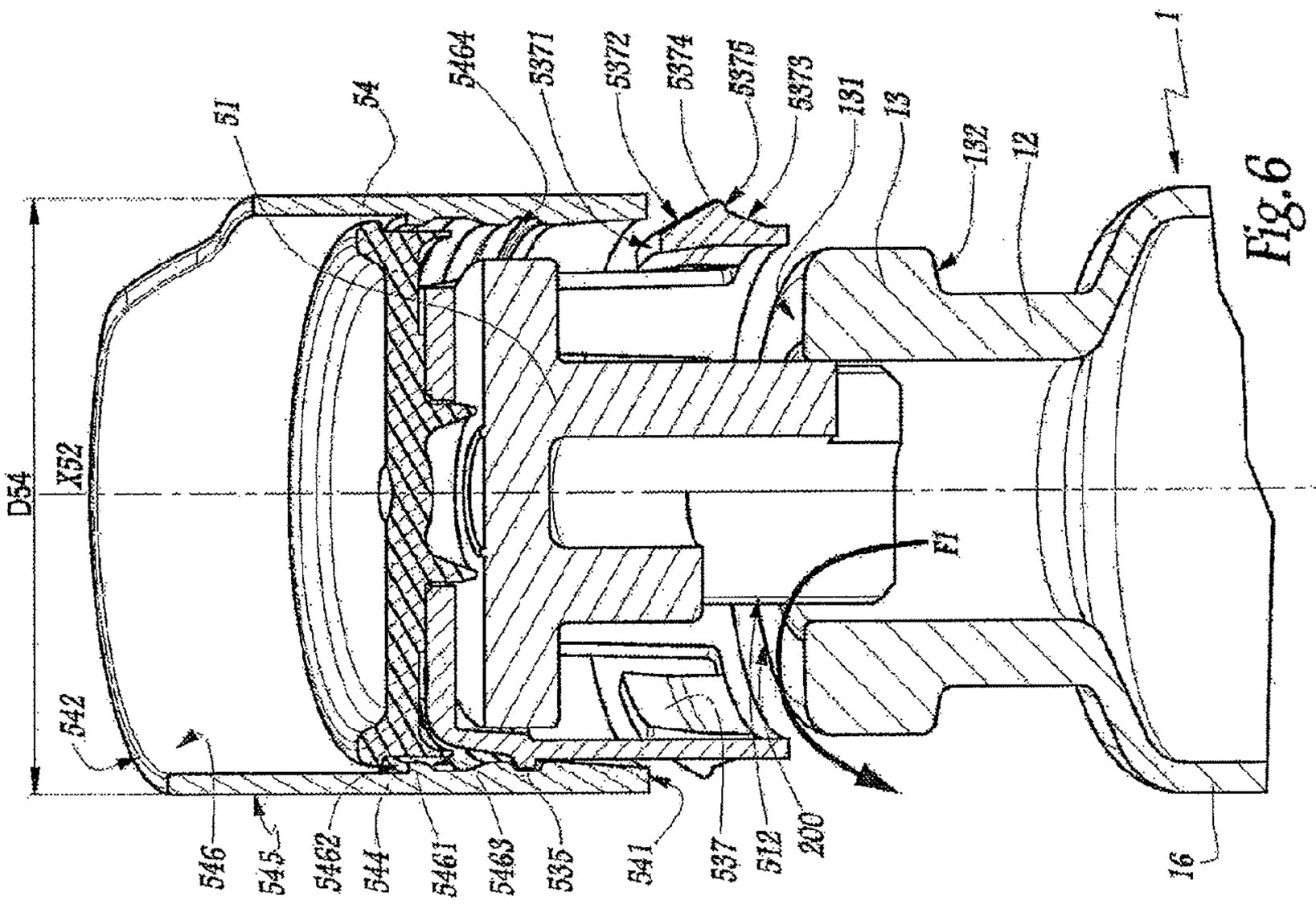
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Fig. 6

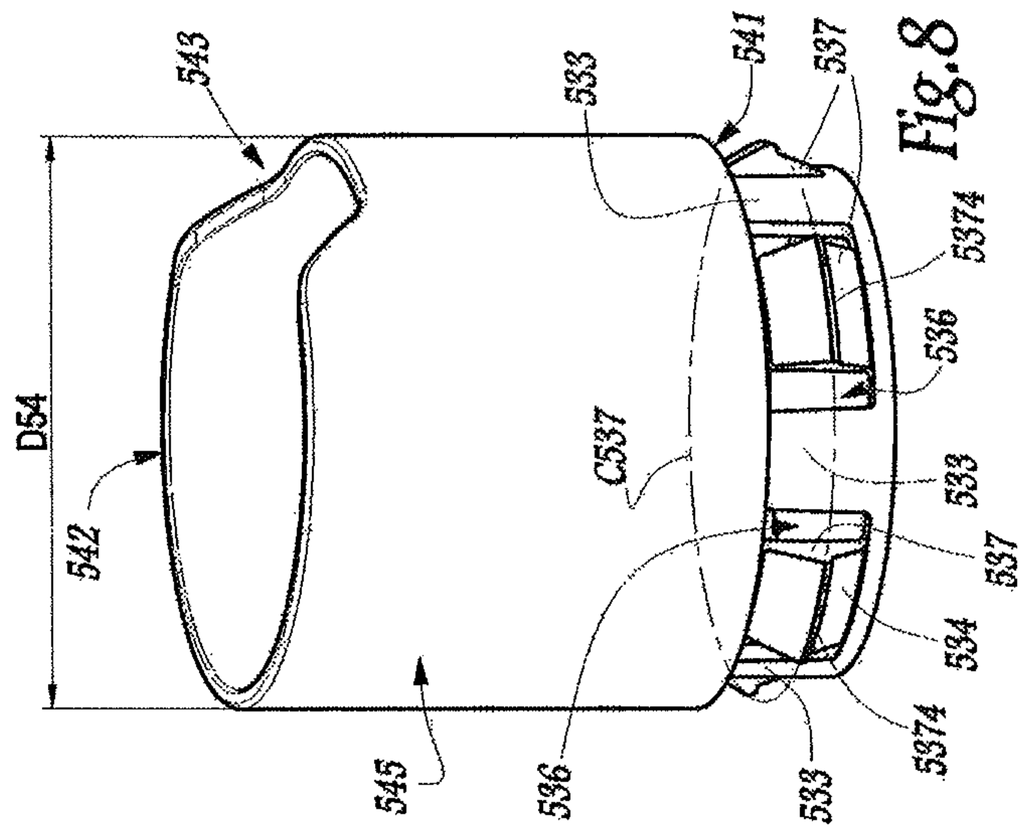
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Fig.8

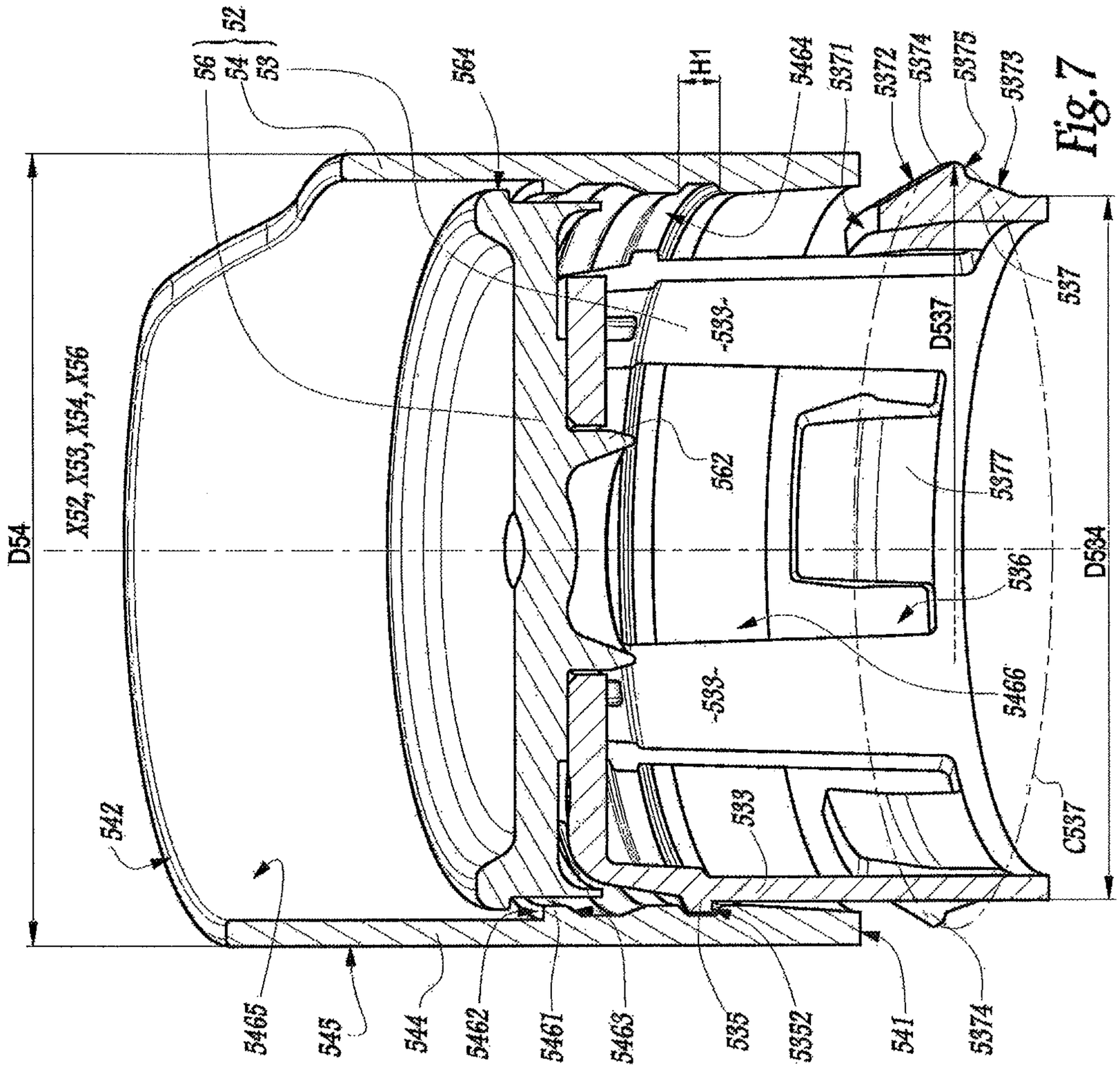
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Fig.7

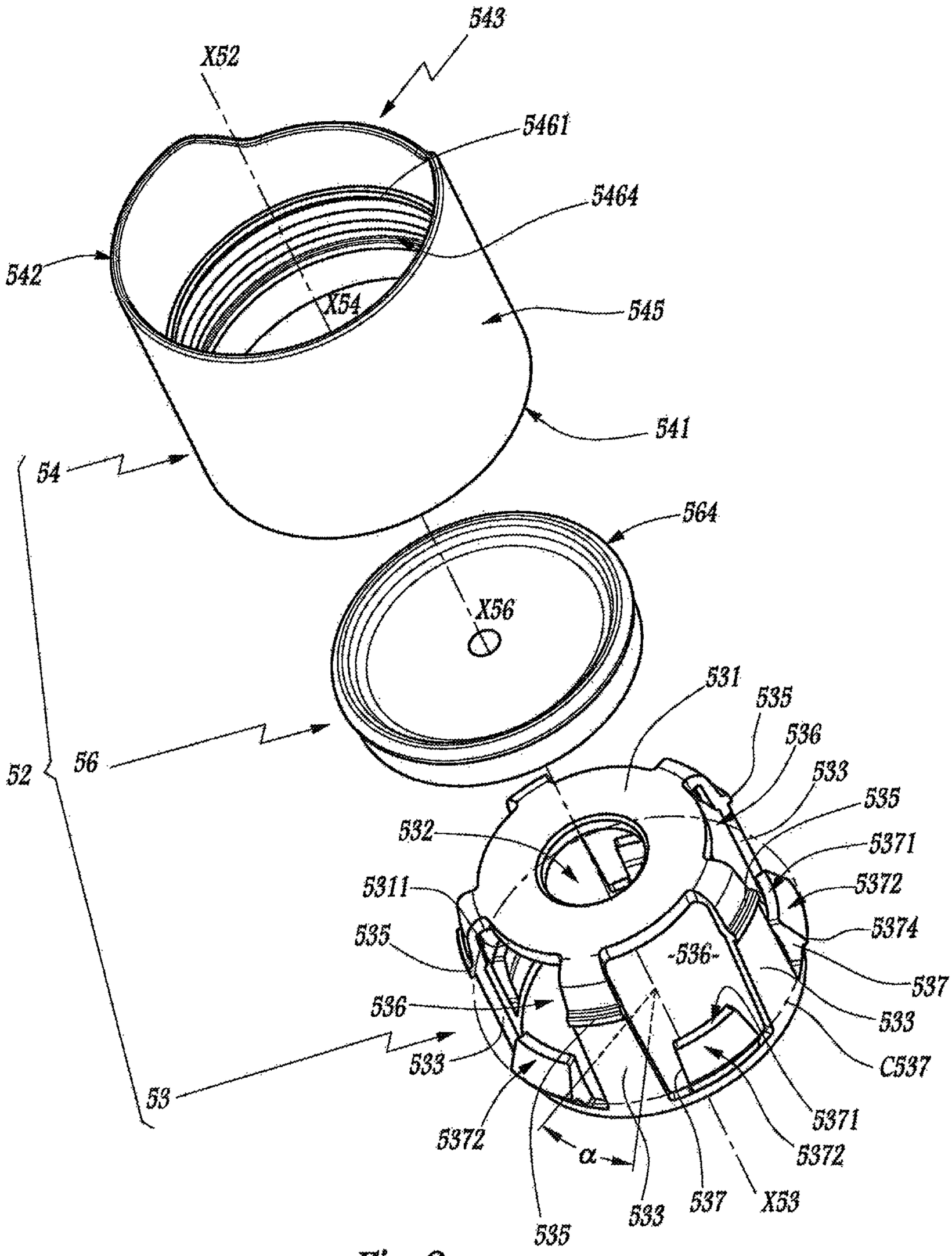
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Fig.9

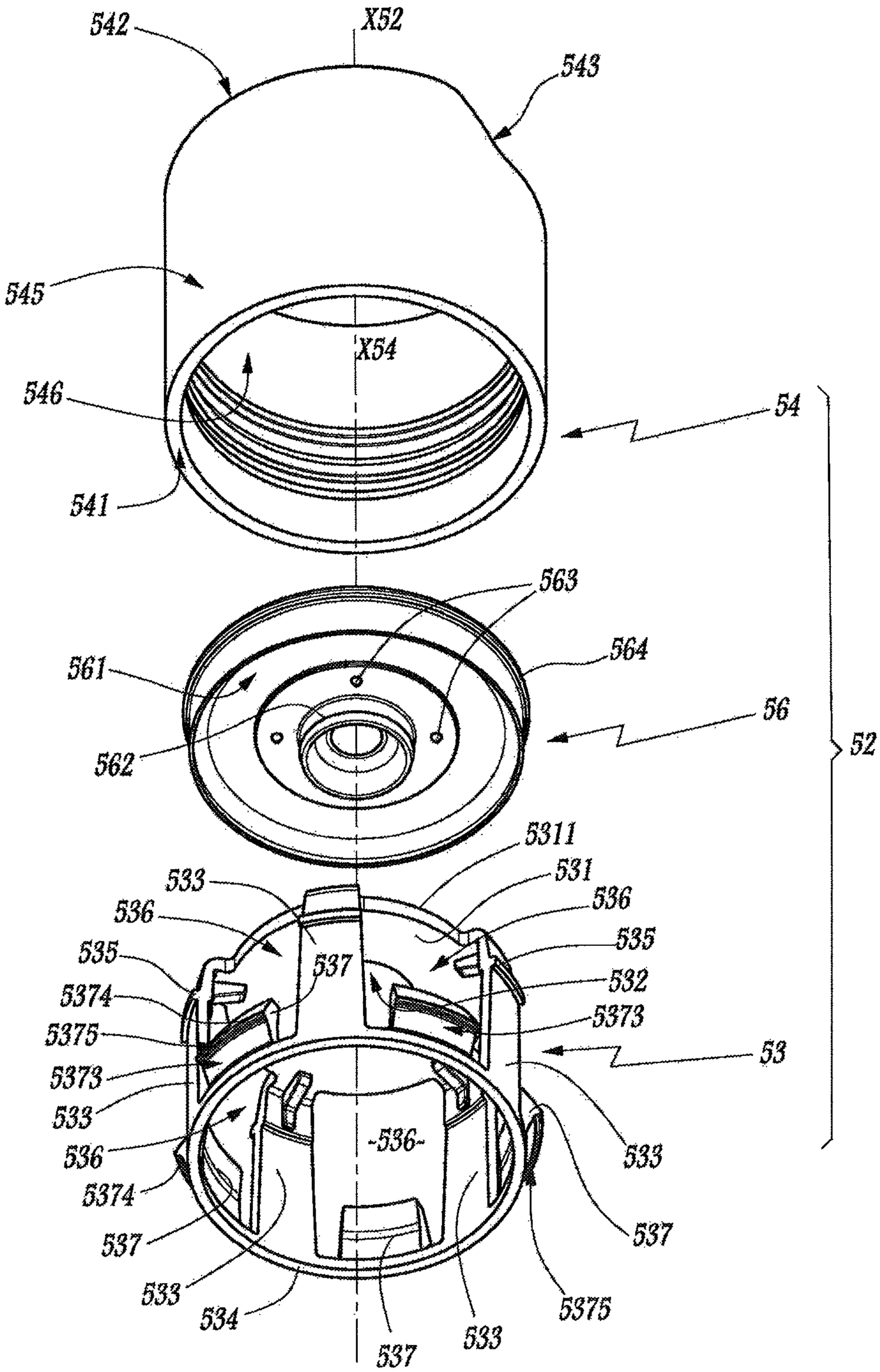
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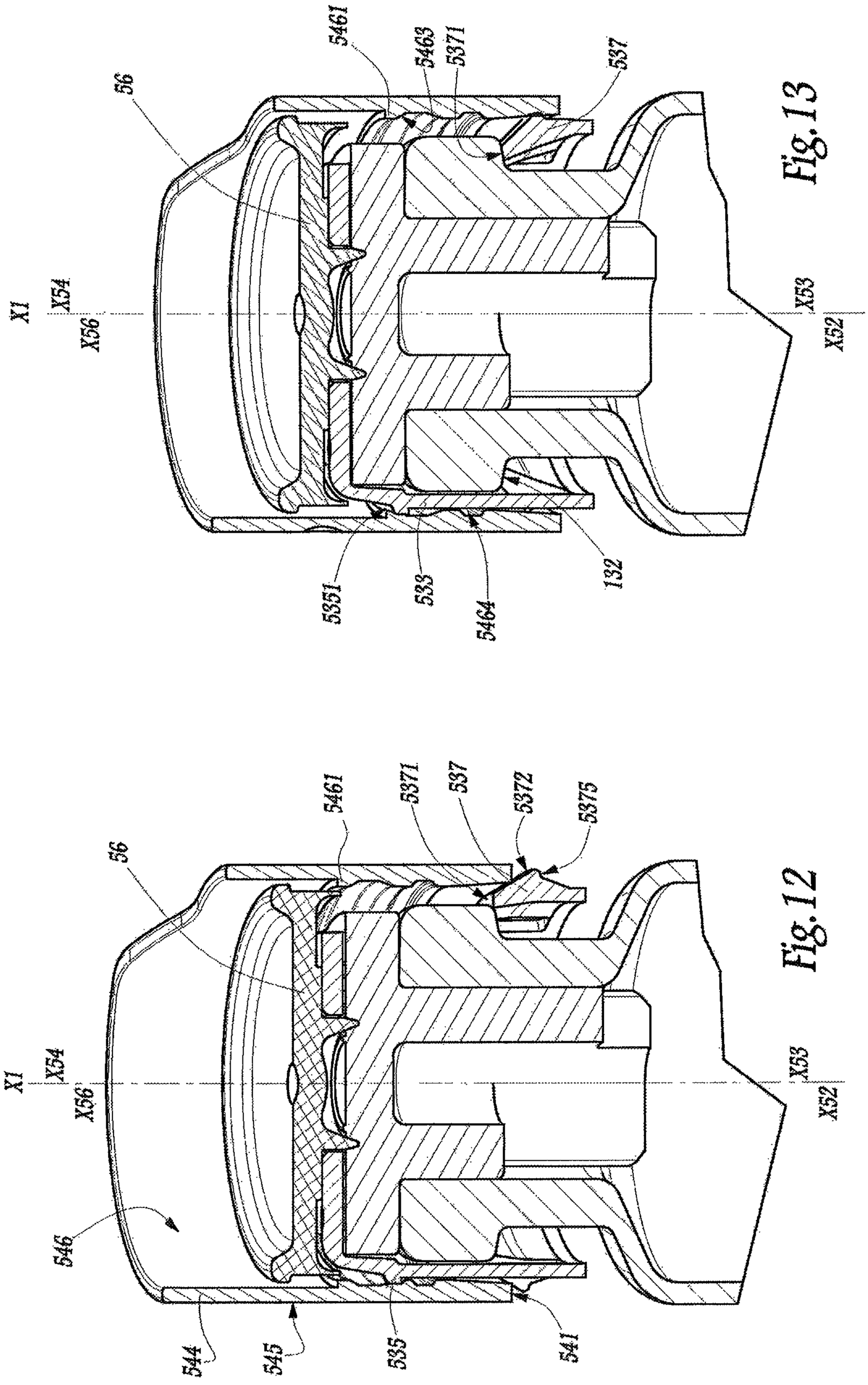
Fig. 10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X53
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5464
132

Fig. 13

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X54
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X53
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Fig. 12

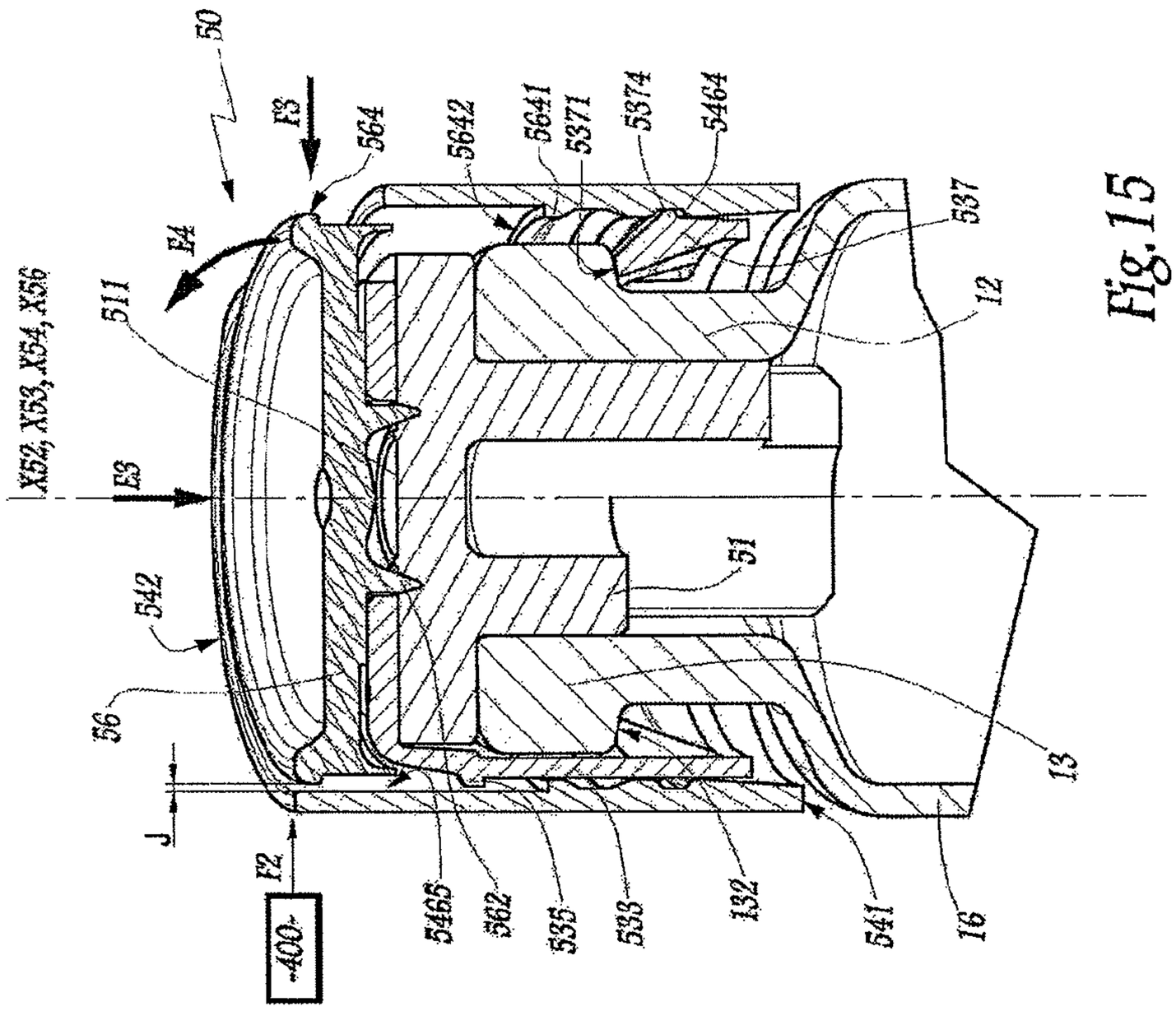
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Fig. 15

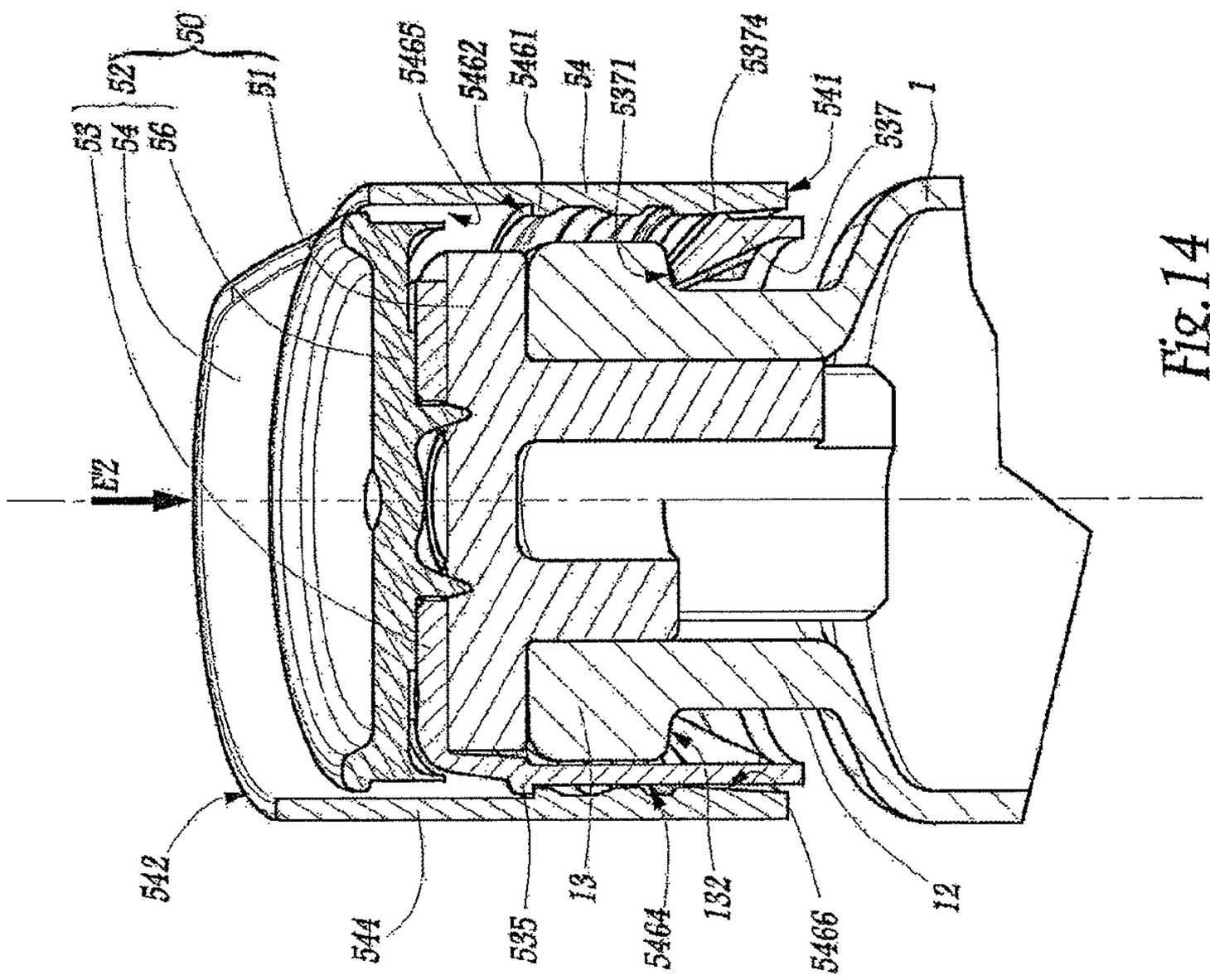
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Fig. 14

DEVICE FOR STOPPING A CONTAINER, CONTAINER PROVIDED WITH SUCH A DEVICE, AND METHOD FOR CLOSING A BATCH OF SUCH CONTAINERS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a Section 371 of International Application No. PCT/EP2011/070815, filed Nov. 23, 2011, which was published in the French language on May 31, 2012, under International Publication No. WO 2012/069538 A1 and the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

The invention relates to a stopping device for a container equipped with a neck, as well as to a container provided with such a device. The invention also relates to a method for closing a batch of containers provided with a stopping device.

In the field of containers for medication, it is common to use a glass vial to preserve an active medicament in the form of lyophilizate, power or liquid solution. Such a vial must be closed in a dry manner in order to maintain its content in a satisfactory preserving state, until the date it is used. In order to hermetically seal a vial, it is common to use a stopping device that consists of a elastomer stopper and plastic cap intended to be fixedly attachable around the stopper to isolate the exterior.

WO-A-2007/063218 offers a stopping device, the cap of which consists of a ring and a body that allows maneuvering the locking means of the ring on the neck of a container. Moreover, WO-A-2008/129144 is known to integrate a deformable transmission element with thrust force into a stopping device which is intended to fade when a thrust force has been sufficiently transmitted to bring a body into a position where it activates the locking means of a cap on the neck of a container. FR-A-2-927-316 discloses the use of a connecting web which connects a peripheral press rim to a central stud and which has a different stiffness over different deformation ranges. FR-A-2 908 396 offers a stopping device in which a ring has a curbed extremity towards the exterior and cooperates with an internal peripheral groove of a ring to maintain locking means in an fixed position of the stopping device. These known devices offer overall satisfaction, particularly when they are used on vials, of which the neck has a diameter of 20 mm.

When these stopping devices are used to seal vials that belong to a batch of vials installed within a freeze-drier, by exercising a thrust force divided over the different stopping devices to bring them into a closed configuration, the thrust force exercised by means of a common body called "pressure plate" is divided over the different stopping devices. When containers with a relatively small diameter, particularly containers with a neck of a diameter of 13 mm, are used it is economically desirable to install a batch of containers previously equipped with stopping devices in a freeze-drier with the largest number of containers possible. In this case, the combined thrust force that is exercised by the pressure plate on each stopping device has a relatively weak intensity, equal to 25 Newtons for a classic freeze-drier. Under these conditions, it is important to minimize the necessary force to bring each stopping device into its usable configuration where it efficiently closes the neck of a container.

The present invention is directed to this problem by offering a stopping device in which the necessary force to bring the device into a usable configuration is minimized.

In this regard, the invention relates to a stopping device of a container provided with a neck, whereby this device contains a stopper and plastic cap, suitable for covering both the neck and the stopper in place on the neck, whereby this cap consists of a ring, suitable for surrounding the stopper and the neck in mounted configuration and provided with locking means on the neck, as well as a handling body of the ring, suitable to be mounted on the ring and provided with a thrust transmitting means for transmission to the ring a thrust force and a locking activation means for activating the locking means of the ring, while the ring and handling body, respectively, are provided with ring retainers and a holding position retaining means that cooperate together to maintain the handling body in a holding position in relation to the ring, where the handling body does not activate the locking means of the ring. In conformity with the invention, in a first position relative to the ring, the handling body is mobile in translation only in the direction of the thrust force, and a second position where the handling body activates the locking means of the ring and where the handling body is immobilized in relation to the ring in axial translation, according to a direction that is parallel to the thrust force, while the handling body comprises a first cylindrical surface with a constant radius or in the shape of an outwardly-inclined, radially inwardly-facing surface arranged facing the ring retainers of the ring, on the course of travel of the handling body between its first and second positions, and a second cylindrical surface with a constant radius or in the shape of an outwardly-inclined, radially inwardly-facing surface arranged facing the locking means of the ring, on the course of travel of the handling body between its first and second positions. Additionally, the locking means of the ring comprise locking tabs that extend from a first continuous edge of this ring, in the direction of the second edge of the ring opposite its first edge, while the diameter of a circle that circumscribes the external radial parts of the locking tabs has a greater value than the external diameter of the first edge and that each tab is arranged in an opening with closed contour which crosses the ring according to a radial direction in relation to a longitudinal and central axis of this ring.

BRIEF SUMMARY OF THE INVENTION

The handling body can be brought from its holding position to its first position where it ensures, through its action with the locking means, the attachment of the device on the container. Then, the two cylindrical surfaces with a constant radius or in the shape of an outwardly-inclined, radially inwardly-facing surface allow for the frictions to be limited between the handling body and the ring during the movement of the handling body between its first and its second position. This results in the fact that the necessary force to bring the handling body from its first to the second position is of limited intensity, and allows for a large number of stopping devices to be acted on simultaneously or to run a control operation based on a calibrated force allowing the handling body to pass from the first to the second position. In addition, the positioning of the locking tabs in the openings with closed contour and the fact that the edge of the ring is continuous gives a certain flexibility to the tabs that is sufficient to fulfill their function, while the ring is resistant, mechanically speaking.

According to the advantageous but non-obligatory aspects of the invention, such a device can incorporate one or several of the following characteristics taken in any combination that is technically acceptable:

The handling body comprises a buttress that prevents the handling body from traveling in relation to the ring, from the

first position and extending to the second position, by cooperating with the ring retainers provided on the ring.

The handling body comprises an annular skirt and the first and second surfaces, as well as possibly the buttress mentioned above, are arranged on an internal surface of this skirt.

The locking means, on the one hand, and the handling body, on the other hand, are respectively provided with first and second immobilizing means that cooperate together in order to immobilize the handling body in translation in relation to the ring in the second position. In this case, the first immobilizing means preferably comprises at least a protrusion arranged on an external radial side of a tab, while the second immobilizing means comprises at least a groove receiving and retaining the protrusion when the handling body is in its second position.

The ring retainers are arranged on deformable bands that extend, according to a direction that is parallel to the thrust force, between an annular part of the ring intended to support on an exposed side of the stopper and annular edge of the ring from which the locking means extend.

A lid is connected with the ring and it isolates a central opening of the ring from the exterior that gives access to an exposed surface of the stopper, while the handling body consists of an annular skirt that surrounds the stopper, except at the level of a notch arranged in a higher edge of the skirt opposite the container in a mounted configuration of the device and when a radial clearance is arranged between the lid and the higher edge of the skirt, at least adjacent to a zone of the skirt diametrically opposite the notch.

The handling body consists of an annular skirt with a circular section that radially surrounds the ring when the handling body is in the holding position and in the first and second positions, while the exterior diameter of the skirt is less than 16.5 mm, and preferably between 15.8 mm and 16.2 mm.

The invention also relates to a container equipped with a stopping device as mentioned above.

To conclude, the invention relates to a method for closing a batch of containers as mentioned above, whereby this method consists of the following phases:

a) pre-assembling each stopping device with its stopper and its cap in a holding position,

b) pre-mounting the devices on the necks of containers by inserting their stoppers in these necks,

c) applying, by means of a pressure body, a common thrust force on all of the devices, in such a way as to completely insert the stoppers in the necks and to bring the handling body of each stopping device in its first position, in its second position or in an intermediary position between these first and second positions,

d) individually applying on each handling body of the stopping devices, a thrust force calibrated in a direction of travel of the handling body from its first position towards its second position,

e) determining if the handling body has reached its second position at the end of phase d), and

f) if the result of the phase e) is negative, identifying the stopping device as incorrectly mounted on the corresponding container.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The invention will be better understood and other advantages of this invention will appear more clearly in the light of the description that will follow an embodiment of a stopping device, of a container and of a method in conformity with its principle, given uniquely by way of example and done with reference to the annexed drawings in which:

FIGS. **1** to **5** represent schematically, in an axial view and in perspective, several phases of packaging a product in the containers in conformity with the invention,

FIG. **6** is a view at a much larger scale of detail VI in FIG. **3**,

FIG. **7** is an axial view, in perspective and at a much larger scale, of the cap of stopping devices of containers of FIGS. **1** to **5**,

FIG. **8** is a perspective view, at a much smaller scale and an exterior view, of the cap represented in a cross-section view in FIG. **6**,

FIGS. **9** and **10** are exploded perspective views, according to two different angles, of the cap of FIGS. **7** and **8**,

FIG. **11** is a view at a much larger scale of detail XI in FIG. **4**, whereby the pressure plate is omitted for the sake of clarity of the drawing, and

FIGS. **12** to **15** are views analog to FIG. **11** during the later phases of a closing method in conformity with the invention.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **1** to **5** represent different phases of packaging of a product P in glass vials **1** that constitute the containers.

In FIG. **1**, a vial **1** is in the process of being filled with a product P, for instance a medicine. A pipette **2** is introduced in a vial **1** through an opening **11** which is defined by a neck **12** that presents an external ring **13**. X1 is marked as the symmetry axis of vial **1**.

When a predetermined amount of the product P has been introduced in the vial **1**, the pipette **2** is removed and a stopping device **50** is placed on neck **12**.

A device **50** comprising an elastomer stopper **51** in adapted form to be partially introduced in the opening **11**, by resting completely on a side **131** of the neck ring **13** opposite the bottom **14** of the vial **1**. Once it is in place in the neck **12**, the stopper **51** separates the content of the vial **1** from the exterior.

The device **50** also comprising a cap **52** intended to cover and isolate the stopper **51** and the neck **12** in a closed configuration of the stopping device **50**.

As it is evident from FIGS. **7** to **10** in particular, the cap **52** has a plastic ring **53**, which has an interior circular section with an internal diameter sufficient to allow it to surround neck ring **13**.

The cap **52** also has a plastic crown (or handling body) **54** which is intended to form the external peripheral cover of the cap **52**. Additionally, the cap **52** also has a lid **56** that is also made out of plastic. This lid **56** is completely in rotational symmetry about a central axis X56.

The lower edge **541** of the crown **54** is oriented towards vial **1** in an installed configuration of the cap **52** on the vial. The edge **541** can be described as being "lower" to the extent that it is oriented towards the bottom in the configuration of FIGS. **2** to **5**. In this description, the spatial orientation of the different elements mentioned is considered in the case where the device **50** is mounted on a vial **1** that rests on a flat surface by its bottom **14**. A part is said to be "lower" when it is oriented towards the bottom in this configuration and is said to be "higher" when it is oriented towards the top.

Top edge **542** of crown **54**, which is opposite the lower edge **541**, is provided with a notch **543**. With the exception of this notch, crown **54** is in rotational symmetry about an axis X54.

The ring **53** is centered on an axis X53 which is aligned with the axes X54 and X56 in the assembled configuration of cap **52**, whereby this axis is concentric with a central axis X52 of cap **52**.

The ring **53** consists of an annular part **531** that defines a central opening **532** through which it is possible to access the top surface **511** of the stopper **51** if need be.

The internal surface **561** of the lid **56** faces the stopper **51** in the mounted configuration of the device **50** on vial **1**. The lid **56** is provided with a skirt **562** centered on the axis X56 and which extends parallel to this axis from the surface **561**.

During the manufacturing of the cap **52**, the lid **56** is placed on the ring **53** by bringing the internal surface **561** of the lid **56** adjacent the annular part **531** of the ring **53**, by introducing the skirt **562** of the lid **56** in the opening **532** in the annular part **531** and by attaching the lid **56** to the annular part **531** by fusing thereto the four platforms **563** arranged, for that purpose, on the surface **561** and equally distributed around the skirt **562**.

When the lid **56** has been fixed on the ring **53**, the crown **54** is engaged around elements **53** and **56** in such a way that it demarcates the maximum radial girth of the cap **52** in relation to axis X52.

In practice, the geometry of the pieces **53**, **54** and **56** is chosen in such a way that the maximum external diameter D54 of crown **54** has a value lower than 16.5 mm, preferably between 15.8 and 16.2 mm, yet more preferably equal to 16 mm.

Under these conditions, when a vial **1** having a body **16** with a diameter that is equal to 16 mm is used, which is common for certain medications, the cap **52** mounted on the vial **1** does not pass or only passes the body of the vial **1** a little bit, in a radial direction in relation to axis X1. This allows for vials **1**, which are previously equipped with a stopping device **50**, to be placed on a shelf of a freeze-drier with high density, resulting from the relatively small diameter of the bodies of these vials without the risk that the vials are destabilized by the stopping devices they support.

The ring **53** comprises five bands **533** that extend from the annular part **531** until a lower edge of the ring **53** which is formed by a continuous ring **534** around the axis X53. The external radial edge **5311** of the annular part **531** defines a second edge or top edge of ring **53** and the bands **533** extend between the edges **534** and **5311**.

Each band **533** is provided with an external rib **535** that juts out radially towards the exterior in relation to the axis X53 in relation to this band. A window **536**, i.e. a open zone with closed contour that puts the interior volume of ring **53** and the exterior in contact, is defined between each pair of two adjacent bands **533**.

A locking tab **537** extends from the continuous ring **534** in each window **536**. Taking into account the intrinsic flexibility of the material that makes up the ring **53**, each tab **537** can pivot around its base in relation to the edge of the continuous ring **534**. In other words, each tab **537** can be more or less displaced towards the interior of the ring **53** in response to an applied force.

The tab **537** has a free edge **5371**. A top external peripheral surface **5372** adjoins the free edge **5371** and extends at an angle relative to the axis X53 radially outwardly terminating in a protrusion **5374** having a generally arcuate shape with a terminus forming a shoulder **5375**. A lower external peripheral surface **5373** extends from the shoulder **5375** at an angle relative to the axis X53 radially inwardly terminating at the edge of the continuous ring **534**.

The edge of the continuous ring **534** has an exterior diameter D534. An imaginary circle C537 having a diameter D537 is centered on axis X53 and passes by the radially outwardly extending protrusion **5374**. In a non-tight position of locking tabs **537**, the value of the diameter D537 is larger than that of the diameter D534, by at least 1.5 mm. Even when the crown **54** surrounds the locking tabs **537**, as envisioned above, the diameter D537 has a value that is larger than diameter D534, whereby the difference between these values is less than when the locking tabs **537** are in the non-tight position.

The ring **53** on the interior of the junction zone between the band **533** and the annular part **531** is provided with ribs **562** intended to superficially penetrate in the stopper **51** in order to immobilize this stopper in the ring **53** and in the cap **52**.

Essentially, the crown **54** consists of a skirt **544** that extends between the edges **541** and **542**, and is a circular cylindrical having an external radial surface **545** and an internal radial surface **546**.

The internal radial surface **546** is provided with a rib **5461** that extends in the direction of the axis X54 and which is demarcated by a top surface **5462** perpendicular to the axis X54 and an lower surface **5463** converging in the direction of the edge **541**.

The surface **546** is also provided with a peripheral groove **5464**, the height H1 of which is measured parallel to the axis X54 is sufficient to receive the ribs **535** of the bands **533** in a configuration where the crown **54** is in a holding position in relation to the ring **53**. This configuration is represented in FIGS. **3**, **6** and **7**.

The surface **546** also consists of a first cylindrical surface **5465** having a constant radius that extends between the rib **5461** and the edge **542** and a second surface **5466** in the shape of an outwardly-inclined, radially-inwardly facing surface, splitting in the direction of the edge **541** and which extends between the groove **5464** and the edge **541**. The surfaces **5465** and **5466** are centered on the axis X53.

The angle of the surface **5466** relative to the axis X53 is less than 10°, preferably equal to 7°.

When the lid **56** has been fused on the ring **53**, as explained above, the crown **54** is engaged around the elements **53** and **56** due to a pre-assembly axial force E1, i.e. parallel to axes X52, X53, X54 and X56 which are then coincident. This results in the fact that the skirt **544** is brought around the bands **533**. This movement continues until the ribs **535** move into the groove **5464** and are locked therein. The sliding of the crown **54** in relation to ring **53** takes place due to the elasticity of the bands **533** that can elastically deform when their respective ribs **535** slid along the surface **5466** of the crown **54**, prior to moving into the groove **5464**. In other words, the geometry of the ring **53** gives the bands **533** a sufficient flexibility so that the placement of the crown **54** around the elements **53** and **56** is easy. In practice, the circumferential width of the bands **533** extend each, in relation to the axis X53 on an angular sector at an angle at the top less than 30°, preferably 25°.

When the cap **52** has been pre-assembled, it is possible to put the stopper **51** in it by introducing it on the inside of the ring **53** until the ribs **562** superficially penetrate in the stopper **51**, which assures that the stopper remains in the ring. Alternatively, the stopper **51** can be placed on the neck **12** of the vial **1**, as presented in FIG. **3** before the cap **52** is placed on the stopper. In all cases, we achieve the configuration of FIG. **3** in which the stopper **51** does not completely cover the opening **11** in the neck **12** since this stopper is provided with a lateral cut **512** that arranges an interstice **200** at the level of part of the top side **131** of the neck ring **13**.

Equipped vial **1** of device **50** can thus be introduced in a freeze-drier **300** within a batch of vials **1**. In FIGS. **3** to **5**, three vials represent a batch that can consist of several hundred, in fact several thousand vials placed in freeze-drier **300**. Additionally, the vials can be placed in this freeze-drier on several platforms placed on top. In this freeze-drier, the water molecules that are present in each vial **1** are evacuated

towards the exterior, as presented by arrow F1 in FIGS. **3** and **6**, through the interstices that remain between the cap **52** and the neck ring **13**.

On the inside of a freeze-drier, as presented in FIG. **4**, it is then possible to apply a thrust force E2 on the devices **50** parallel to the longitudinal axis X1 of the vials **1** and the neck rings **11**, the axis with which the axes X52 of different caps **52** are coincident. This axial force E2 is applied by a mobile plate **301** on the inside of the freeze-drier and commanded by an actuator **302**. At the same time, the plate **301** sensibly applies the same joint force E'2 on the cap **52** of each vial **1** of a row of vials placed at the same level, on the same platform **303** in the freeze-drier.

The sum of forces E'2 is equal to the force E2.

In the configuration of FIGS. **4** and **11**, the crown **54** is in a holding configuration to the extent that it does no longer interact with locking tabs **537**.

The application of force E2 results in the progression of the crown **54** of each cap **52** in the direction of the bottom **14** of each of vials **1**, as presented by the passage from the configuration of FIGS. **3** and **6** to that of FIGS. **4** and **11**. Force E'2 is transmitted from the crown **54** to the ring **53** by means of the groove **5464** and the ribs **535** that cooperate. Thus, the force E'2 applied on each device **50** results in bringing the tabs **537** of its ring **53** between the neck ring **13** and the body **16** of the vial, around the part of the neck **12** not provided with the neck ring **13**.

The outwardly-inclined, radially inwardly facing surface **5466** progressively deflects the locking tabs **537** from the position of FIG. **13** to that of FIG. **15**.

The annular part **531** comes thus in contact with the top surface **511** of the stopper **31** which stops the progression of the ring **53** in the direction of the bottom **14**. The continuation of the application of force E'2 on the crown **54** of each device **50** results in displacing the rib **535** of each band **533** on the exterior of groove **5464** by elastic deformation of the bands **533**, which allows the crown **54** to attain the positions of FIGS. **12** to **14** successively. This allows, in an initial instance, the edge **541** of the crown **54** to come in contact with the surfaces **5372** of the different tabs **537**, as presented in FIG. **12**. The continuation of this movement results in sliding the surfaces **5372** against the edge **541**, which moves back the tabs **537** radially towards the axis X1, by bringing their free edges **5371** against the lower peripheral surface **132** of the neck ring **13**, as presented in FIG. **13**. This movement also results in the fact that the ribs **535** come in contact with the rib **5461**. The top surfaces **5351** of the ribs **535**, which are oriented towards the annular part **531**, are in the shape of an outwardly-inclined radially-outwardly facing surface and converge towards the axis X53 by approaching the annular part **531**. Thus, when the ribs **535** and **5461** come in contact by their surfaces **5351** and **5463**, as presented in FIG. **13**, these surfaces are in sliding contact. This allows deformation of the bands **533** elastically and progressively at the point where the ribs **535** radially move back towards the interior, i.e. in the direction of the axis X53 to pass the rib **5461** by approaching the edge **542**.

This movement continues until the configuration of FIG. **14** is attained where the ribs **535** have slid against the lower surface **5463** of the rib **5461** and have come to be locked on top of the latter, by being in support against the surface **5462** of this rib. In this respect, the lower surface **5352** of each rib **535**, which is turned towards the edge **534**, is perpendicular to the axis X53. Thus, in the configuration of FIG. **14**, which forms a first remarkable position for the constituent elements of the cap **52**, the surfaces **5352** and **5462** offer surface support and are perpendicular to the axis X1, in such a way that they efficiently oppose any travel of the ring **54** opposite the bottom **14**, i.e. in a direction opposite that of the joint force E'2 applied on the crown **54**. In this configuration, i.e. when the crown **54** is in its first position in relation to the ring **53**, the ring **53** is efficiently retained in position in relation to a wrenching movement that has the tendency of separating from the bottom **14**, due to the cooperation of the ribs **535** and **5461**.

When ring **53** is in its first position of FIG. **14**, device **50** is in an intermediary or non-finalized configuration in which a relative axial movement between elements **53** and **54** remains possible within the limits set by the buttress formed by the rib **5461**. The continuation of the application of the individual thrust force E'2 on the edge **542** of the crown **540** results in passing this from the position of FIG. **14** to the position of FIG. **15** by sliding the radially outwardly extending protrusions **5374** of the locking tabs **537** against the surface **5466** of the skirt **544** until these radially outwardly extending protrusion **5374** move into the groove **5464**, as presented in FIG. **15**. In this configuration, the crown **54** is axially immobilized along the axes X52, X53, X54 and X56 which are coincident, in relation to the ring **53** due to the cooperation of the radially outwardly extending protrusions **5374** and the groove **5464**.

Ideally, in terms of the action of the actuator **302**, i.e. in the configuration of FIG. **5**, all devices **50** should be in the configuration of FIG. **15**. Nevertheless, due to a possible planar defect of the platform **303** or of the plate **301** and the manufacturing tolerances of vials **1** and devices **50**, the necessary course to bring the crown **54** in the position of FIG. **15** can vary from vial **1** to another. Thus, as presented in FIG. **5**, the two vials on the left on this figure can have their device **50** in the configuration of FIG. **14** while the vial on the right side has its device **50** in the configuration of FIG. **15**. In other words, the course of the plate **301** is regulated so that all devices **50** that equip the different vials **1** mounted on a platform **303** reach at least the configuration of FIG. **14**, starting from the configuration of FIG. **11** whereby certain ones of these can arrive at the position of FIG. **15** or in an intermediary position between those of FIGS. **14** and **15**.

As the radially outwardly extending protrusion **5374** of the tabs **537** slide on the surface **5466** during the travel from the cap **54** of the position of FIG. **14** to that of FIG. **15**, while the ribs **535** travel parallel to the surface **5465** without coming in contact with it, the resistant force that is endured by the crown **54** is less when the crown **54** travels from its first position to its second position in relation to the ring **53**.

In the configuration of FIG. **14**, the crown **54** is in its first position in which the skirt **544** ensures, through the bracing it exerts on the tabs **537**, that these tabs are maintained in a configuration engaged with the surface **132** of the neck ring **13**. In other words, the crown **54** forms a handling body of the ring **53**, which actives the locking means formed by the tabs **537**. In this position, the crown **54** can travel in the direction of the bottom **14** but cannot separate from this bottom since it is blocked by the cooperation of the ribs **535** and **5461**.

In terms of lowering movement of the plate **301**, it is possible to extract vials **1** of the freeze-drier **300** and to submit each in turn to a calibrated individual force E3, the magnitude of which is for instance equal to 20 Newtons. The application of this force E3 allows to slide the crown **54** in the direction of the bottom **14**, i.e. approach its edge **541** of the body **16** of the vial **1**, by sliding around the elements **53** and **56**. This sliding movement is hardly slowed down since the single point of contact between the crown **54** and ring **53** is the support zone of the radially outwardly extending protrusion **5374** on the surface **5466**, which induces a weak friction force.

Taking into account this weak friction force between the pieces **53** and **56**, the force E3, which has a relatively weak magnitude, is sufficient to normally bring the ring **54** of each device **50** in the configuration of FIG. **15** or in an intermediary configuration between those of FIGS. **14** and **15** into its second position in which the radially outwardly extending protrusions (or first immobilizing means) **5374** are moved in the groove (or second immobilizing means) **5464** in such a way that the crown **54** is immobilized in translation parallel to the axis X1 in the two directions, i.e. in the same direction as the force E3 and in the inverse direction. In this position presented in FIG. **15**, the crown **54** immobilizes the tabs **537** in a configuration engaged with the surface **132** of the neck ring **13**.

As the force E3, which is necessary to bring the crown **54** from its position of FIG. **13** to its position of FIG. **15**, is of weak intensity, it can be used to verify the proper assembly of the device **50** on the neck **12** of the vial **1**. In fact, from the freeze-drier **300** it is possible to subject each vial **1** to a force E3 that is calibrated, i.e. the value of which is predetermined, and then to verify the position of the crown **54** along axis X1, after application of this force. To do so, an optical device **400** illuminates the top edge **542** of the crown **54** in the direction of the arrow F2 in FIG. **15**, which makes it possible to determine the position of this crown along the axis X1. This position must be comprised in a predetermined slot that corresponds to the reception of the radially outwardly extending protrusions **5374** in the groove **5464**. The slot in the direction of the arrow F2 allows to determine if the crown **54** has efficiently reached its second position.

If such is not the case, the vial **1** is identified as presenting a defect in the measure where the stopping device **50** is not correctly mounted on vial **1**. This vial **1** is thus eliminated from the chain of production. In other words, the force E3 has a double function: it allows to bring all devices **50**, which equip vials **1** from the freeze-drier **300** in the configuration of FIG. **15** or the crown **54** is immobilized axially in relation to the vial **1** and maintains the tabs **537** in locking configuration; this force also allows to verify the proper assembly and proper mounting of the device **50**. In fact, in case of a bad assembly, this force is not sufficient to bring the cap **54** in the configuration of FIG. **15**, which is detected by the device **400**.

In the configuration of FIG. **15**, the external edge **564** of the lid **56** is accessible laterally, in the direction of the arrow F3, through the notch **543** of the crown **54**.

This allows to exercise a wrenching force E4 of the lid **56** in relation to the ring **53**, to access the opening **532** and, through the latter, to the top surface **511** of the stopper **51**.

A radial clearance J is defined between the edge **564** of the lid **56** and the part of surface **5465** of the skirt **544** which is located in proximity to this edge in this configuration. This clearance J allows the force E4 to effectively detach the stopper **56** from the ring **53** by breaking up the fused points that results in the merger of the platforms **563** and by extracting the skirt **562** from the opening **532**. Clearance J is arranged on the main part of the periphery of the lid **56**, between this lid and the edge **542**. Alternatively, it can only be arranged in the vicinity of the zone of the skirt **544** opposite the notch **543** since it is in the vicinity of this zone that the lid **56** must move forward laterally towards the left side in FIG. **15**.

We notice in FIGS. **8** to **10** that, to the extent where the tabs **537** extend from the edge **534** and in the direction of the annular part **531** within the windows **536**, they do not risk getting tangled with the tabs of the pre-assembled cap **52**, i.e. mounted in the configuration of FIG. **8** which forms progress in relation to the case where the tabs extend towards the bottom starting from the edge of a ring.

The invention has been described in the case where the surface **5465** is cylindrical while the surface **5466** is in the shape of an outwardly-inclined radially-inwardly facing surface. Alternatively, the surface **5466** can be cylindrical with a circular base. According to another variable, the surface **5466** can also be slightly in the shape of an outwardly-inclined radially-inwardly facing surface with a clearance angle of a few degrees, less than 4° that aims at facilitating the release of the crown **54**.

The constituent elements of cap **52** can be molded in polyoxymethylene (POM) or in an equivalent type of material.

It will be appreciated by those skilled in the art that changes could be made to the embodiments described above without departing from the broad inventive concept thereof. It is understood, therefore, that this invention is not limited to the particular embodiments disclosed, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the appended claims.

I claim:

1. Stopping device for a container having a neck, the stopping device comprising:

an elastomeric stopper; and

a polymeric cap comprising:

a ring configured to surround the stopper and the neck of the container; and

a handling body movable relative to the ring along a central longitudinal axis of the ring,

wherein the ring comprises:

ring retainers which extend radially outwardly from the ring; and

a locking means configured to engage the neck of the container, the locking means comprising:

locking tabs which extend upwardly from a first continuous edge of the ring, each locking tab arranged in an opening with a closed contour which crosses the ring according to a radial direction in relation to the central longitudinal axis of the ring,

wherein a diameter of a circle which circumscribes the locking tabs has a value that is greater than an external diameter of the first continuous edge of the ring, and

wherein the handling body comprising:

a thrust transmitting means for transmitting to the ring a thrust force applied to the handling body;

a locking activation means for activating the locking means of the ring;

a holding position retaining means which cooperates with the ring retainers to maintain the handling body in relation to the ring in a holding position;

a first cylindrical surface with a constant radius, arranged facing the ring retainers when the handling body moves between a first position in relation to the ring and a second position in relation to the ring; and

a second cylindrical surface in the shape of an outwardly-inclined, radially inwardly-facing surface arranged facing the locking means of the ring when the handling body moves between the first position and the second position,

wherein the handling body does not activate the locking means of the ring when the handling body is in the holding position relative to the ring,

wherein the locking activation means activates the locking means of the ring and the handling body is

movable in translation only in a direction of the thrust force when the handling body is in the first position relative to the ring,

wherein the locking activation means activates the locking means of the ring and the handling body is immobilized in relation to the ring in axial translation, according to a direction that is parallel to the thrust force when the handling body is in the second position relative to the ring, and

wherein the handling body is movable, parallel to the direction of the thrust force and in relation to the ring between the first position and the second position.

2. Device according to claim **1**, wherein the handling body comprises a buttress that blocks the handling body from travelling upwardly from the first position in relation to the ring by extending radially inwardly and cooperating with the ring retainers.

3. Device according to claim **2**, wherein the handling body comprises an annular skirt and the first and second surfaces and the buttress are arranged on an internal surface of the skirt.

4. Device according to claim **1**, wherein the locking means and the handling body are respectively provided with first and second immobilizing means that cooperate together to immobilize in translation the handling body in relation to the ring when the handling body is in the second position.

5. Device according to claim **4**, the first immobilizing means comprises at least one protrusion extending radially outwardly from each locking tab and the second immobilizing means comprises at least a groove receiving and retaining the protrusion when the handling body is in the second position.

6. Device according to claim **1**, wherein the the ring retainers are placed on deformable bands that extend, in a direction that is parallel to the central longitudinal axis of the ring, between an annular part of the ring supportable by a top side of the stopper and an annular edge of the ring from which the locking means extend.

7. Device according to claim **1**, wherein a lid, separate from the ring and covering a central opening in an annular part of the ring provides access to an exposed surface of the stopper, the handling body comprises an annular skirt that surrounds the stopper, the annular skirt having a notch in a top edge of the skirt a radial clearance is arranged between the lid and the top edge of the skirt, at least in a portion of the skirt diametrically opposite the notch.

8. Device according to claim **1**, wherein the handling body comprises an annular skirt with a circular section that surrounds the ring radially when the handling body is in the holding position and in the first and second positions and the skirt has an exterior diameter less than 16.5 mm.

9. Container equipped with a stopping device according to claim **1**.

10. Closing method for a batch of containers according to claim **9**, comprising the steps of:

a) pre-assembling each stopping device with its stopper and its cap in the holding position,

b) pre-mounting the devices on the necks of containers by inserting their stoppers in these necks,

c) applying, by means of a pressure body, a common thrust force on all of the devices in such a way as to complete insertion of the stoppers in the necks and to bring the handling body of each stopping device in its first position, in its second position or in an intermediary position between these first and second positions,

d) individually applying a calibrated thrust force on each handling body of the stopping devices in direction of travel of the handling body from its first position towards its second position,

e) determining if the handling body has reached its second position at the end of the step d), and

f) if the result of step e) is negative, identifying the stopping device as incorrectly mounted on the corresponding container.

11. Device according to claim **8**, wherein the exterior diameter of the skirt is between 15.8 mm and 16.2 mm.

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